Engine Coolant Filter Apparatus and Method

by

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BACKGROUND

RELATED APPLICATIONS

This application is a continuation-in-part application of Application number 09/931,230 filed August 16, 2001, which will issue as U.S. Patent No. 6,582,613 on June 24, 2003.

FIELD OF INVENTION

This invention relates to a method and apparatus for filtering particulate matter from internal combustion engine coolant where a filter is connected between the heater core supply and return lines.

DESCRIPTION OF THE PRIOR ART

The use of engine coolant filters is known in the prior art.

U.S. Pat. No. 5,948, 248 to Gene W. Brown, issued September 7, 1999, describes an engine coolant filter which provides a delayed release of chemical additives to the coolant system.

U.S. Pat No. 5,382,355 issued January 17, 1995, to Daniel A. Arlozynski discloses an Engine coolant filter having an automatic clogged-filter bypass valve and a visual indicator.

U.S. Pat. No. 3,776,384 to Offer discloses a replaceable element coolant filter including a pleated paper filter element for use in an existing water filter housing for internal combustion engine cooling systems by means of a grommet that serves to seat the element and seal it around

the housing outlet.

U.S. Pat. No. 3,682,308 to Charles L. Moon, issued August 8, 1972, describes an engine coolant filter comprising a filter base connected to a coolant conduit, a removable filter body, and check valves.

There is a need for a relatively simple and inexpensive coolant filter system which can be installed on new engines, or retrofitted to existing engines. It is desirable to provide a filter and a filtration method that will not adversely impact the operation of a vehicle or engine when the filter becomes plugged. It is desirable to provide a filter and filtration method that will filter coolant even when the vehicle heater is not turned on.

SUMMARY OF THE INVENTION

The current invention is an engine coolant filter system and method for directing a portion of the normal coolant flow through heater hoses to a cartridge or media filter in order to remove particulate matter such as rust and scale.

An object of the present invention is to provide an improved engine coolant filter system for removing particulate matter such as scale and rust from an internal combustion engine cooling system.

In one embodiment, the filter is provided in a housing which may be directly inserted between the heater hoses so that additional fittings are not required. In this embodiment a portion of the flow is directed from the heater core supply line through the filter media to the heater core return line. The flow through the filter may be countercurrent such that flow from the heater supply line enters the housing at a first end, and exits the housing at an essentially opposite second end; and the flow from the heater return line enters the housing at the second end and

exits the housing at the first end. The filter may be placed directly in the existing flow path by removing a section of the heater supply and return hoses, or may be located at a desired location such as above a wheel well or near exsiting supports.

Some embodiments of the invention include replaceable filter cartridges, such that a new cartridge may be installed in a filter housing. Other embodiments include a disposable housing, such that both the housing and the filter media are replaced.

Engine coolant flows into an inlet port on the filter housing, and a portion of that flow is forced through a filter medium, and exits the filter housing through an outlet port. Preferably, a portion of the overall flow of coolant through the engine is directed through the filter at all times that the engine is operational. By continuously filtering a relatively small portion of the overall coolant flow, the concentration of rust and scale is substantially reduced, thereby reducing corrosion and fouling, and improving thermal efficiency in the radiator.

The filter is preferably sized for various vehicles so that it may be replaced at the same time as the oil filter is normally changed, such as by the owner or by an oil changing service center.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects and advantages of the present invention are set forth below and further made clear by reference to the drawings, wherein:

FIG. 1 is a top view of an engine compartment with a heater core having a supply and a return line.

FIG. 6A is a top view of a block filter

FIG. 6B is an end view of a block filter

FIG. 6C is a side view of a block filter

FIG. 6D is a top cross-sectional view of a block filter

FIG. 6E is a top view of a block filter with a bolt-on housing

FIG. 7 is a perspective view of a cylindrical block filter

FIG 8 .is a detail of hose fittings

FIG. 9 is a side cross-sectional view of a block filter mounted on a wheel well mounting plate

FIG. 10 is a side cross-sectional view of a block filter mounted directly to a wheel well

FIG. 11 is a side cross-sectional view of a block filter strap-mounted on a wheel well

FIG. 12 is a perspective view of an embodiment

FIG. 13 is a perspective view of an alternate embodiment

DESCRIPTION OF COUNTERCURRENT HEATER HOSE INSTALLATION EMBODIMENT

Referring now to FIG. 1, which is a top view of a heater hose embodiment of ~~the~~ an engine coolant filtration system **10,** the system is comprised of an engine block **11,** a radiator **12,** a water pump **16** (not shown)**,** a heater core **20,** a heater core supply hose **22** for providing engine coolant from the water pump to the heater core, and a heater core return hose **24** for delivering engine coolant from the heater core to the water pump **16.**

Referring now to FIG. 12, which is a perspective view of a heater hose embodiment of the engine coolant filtration system, a filter **71** is installed between the heater core supply hose **22** and the heater core return hose **24**. In this example, the filter is positioned between the heater hoses and near the heater block, so that the heater block helps support the weight of the filter. In other embodiments, the filter is located near existing supports such as the wheel well, or firewall

or existing bracket, and the heater hoses are run to the filter. In some cases, the heater hose may be replaced with longer sections in order to reach the filter.

The filter media **83** may be a replaceable paper filter in a generally elliptical housing **41** of length 6 inches, and width 3 inches, and height 1 ½ inches. Other filter types such as plastic, sand, and diatomaceous earth may be substituted for the paper filter. The housing includes an inlet port **42** and an exit port **43** so that a flow path is provided from the inlet port through the filter media and out the outlet port.

The filter is preferably sized so that a volume of about 3 to 5 times the total coolant in the cooling system is directed through the filter per hour of operation. For a coolant system of two gallon capacity, the preferred flow rate through the filter is about 6 to 10 gallons per hour, or about 0.1 to 0.16 gallons per minute. The housing is preferably about 6 inches long and 3 inches in diameter, so that it can trap about a pound of particulate matter before requiring replacement.

The filter may be manufactured by preparing the housing in two pieces, such as by injection molding, then inserting the filter media in one of the pieces, then attaching the second piece such as by gluing, threading, or welding.

The heater core supply hose **22** and heater core return hose **24** are typically ½ to ¾ inch diameter rubber hoses.

The filter is preferably sized for particular vehicle coolant capacities so that it may be replaced when the oil filter is normally changed, such as by the owner or by an oil changing service center.

DESCRIPTION OF RECTANGULAR HOUSING DIRECT CONNECT HEATER HOSE EMBODIMENT

Referring now to FIG 6A-6D, another embodiment of the invention features a housing **71** that includes connections **72** and **73** for the heater supply hose so that a section of the heater hose may be removed and the housing and may be inserted between the ends of the remaining hose. Similarly, the heater return line may be cut, and the return connections **74** and **75** may be inserted between the ends of the remaining supply hose. In this embodiment, most of the heater supply flow may continue through a passage **80** within the housing, but a portion of the flow is directed through an opening **81** in the passage where it can flow through a filter media **83**. Similarly, most of the heater core return flow may continue through a passage **84** within the housing, and the portion of flow which has passed through the filter media may enter the return line through an opening **82** in the passage.

This filter may be manufactured by preparing the housing in two pieces, such as by injection molding, then inserting the filter media in one of the pieces, then attaching the second piece such as by gluing, threading, or welding. The filter media may be paper, sand, diatomaceous earth, plastic, or other media.

In one embodiment, this filter may be fastened within the engine compartment by using one or more flanged ears **76**.

The hose connections **72, 73, 74**, and **75** may be a single size. Alternately, the connections may be a universal fitting as shown in FIG 8 so that the fittings may accommodate hoses of different diameters.

This filter is not limited to engine coolant, but may be used for other fluids.

DESCRIPTION OF EMBODIMENT

Referring now to FIG 7, in one embodiment, a cylindrical or elliptical housing **71** may be inserted between cut-out sections of heater supply and heater return hoses. This embodiment is similar to the rectangular housing described above, with heater supply and return flow going through the housing with a portion of the flow directed through a passage **81** in the supply line, through the filter media **83**, and back through a passage in the return line **82**.

Referring now to FIG 7, in this embodiment, a cylindrical housing which is inserted between cut-out sections of heater supply hose **22** and the heater return hose **24**. The heater supply hose **22** is connected to the filter at the supply inlet port **74**, such as with a hose clamp. The supply flows through a supply channel **80** to a supply outlet port **75**. The heater return hose **24** is connected at heater return inlet port **72**. The return flow is through a return channel **84** to an outlet port **73**. The pressure in the supply passage **80** is greater than in the return passage **84**, so a portion of the supply flow is directed through a filter media inlet port 81 through a filter media **83** to a filter media outlet port **82** and then to the outlet port **73**.

The amount of flow directed through the filter may be modified by increasing the pressure drop between the heater supply line and the heater return line. In general, the filter may be installed between the supply and return lines for a pressure drop device. In one embodiment, the pressure drop device is a heater valve in a heater core for an automotive vehicle.

In this embodiment, the filter will operate in a first state where the heater valve is open and a portion of the flow in the heater supply line goes through the filter be pass channel **80** and onto the heater, and another portion of the flow is directed through the filter media to the heater return line. The filter will also operate in a second state where the heater valve is closed and

flow is from the heater supply hose through he filter media. In the case where the heater is operating, the flow in the filter housing may be countercurrent with flow in the supply passage **80** in a first direction and the flow in the return passage **84** in an essentially opposite direction. In the countercurrent example, if the filter media becomes clogged. Then there can still be flow to and from the heater through the supply and return passage.

Until the heater becomes clogged, it will continue to filter particulates when the heater is not operational. In this case, all flow through the heater supply inlet part **74** is directed though the filter media inlet part **81**, through the filter media **83** and out the return outlet port **73**. When the filter becomes clogged, there will be no flow through the filter media, and the heater supply line will remain pressurized as it would in operation without a filter when the heater valve is closed. Therefore, in either case of heater on or off, there is no adverse affect of the filter media becoming clogged.

In this embodiment, the filter housing may be a material such as metal or plastic. The housing may be sealed for one-time use so that it is typically replaced, such as at an oil change operation. Alternately the housing may be threaded in two or more pieces and screwed, or otherwise assembled so that the filter media may be accessed and replaced without removing the housing from the supply and return hoses.

DESCRIPTION OF TIRE WELL INSTALLATION EMBODIMENT

Referring now to Fig. 9, the filter housing **30** may be installed on a mounting plate **110** which is bolted to a wheel well **200.** The filter housing may be fastened to the mounting plate with bolts **100** and nuts **101** through the flange ears **76.**

In an alternate installation as illustrated in Fig. 10, the filter housing **30** may be attached

directly to a wheel well **200** with bolts or sheet metal screws through bolt-holes **115** in the housing.

In an alternate embodiment, the housing may be attached to a mounting bracket using the bolt-holes.

Referring now to Fig 11, the housing may be attached to the wheel well with one or more mounting straps **116**.

In another embodiment, as illustrated Fig 6E, the housing may be bolted to a bracket or to the engine compartment with one or more bolts through bolt holes **77** in the housing.

DESCRIPTION OF HEATER HOSE SUPPORTED EMBODIMENT

The filter assembly may be installed between the heater supply hose **22** and the heater return hose **24**, and be supported by those hoses. When full of engine coolant, the filter assembly can be supported by one or both heater hoses if the filter assembly is connected to the heater hose near a heater hose clamp.

DESCRIPTION OF EMBODIMENT- OBLONG HOUSING

Referring now to Fig. 12 which is a perspective view of an embodiment of the filter housing, the hosing may be relatively thin in order to fit in the engine compartment of a vehicle. In this example, the filter is 6 inches long, with a width of 3 inches and a height of 2 inches. A single pass pleated paper filter media is used, having a nominal removal of particulates to about 5 microns. The filter has approximately 20 square inches of area and will hold about 4 ounces of filtered particulates.

Referring now to Fig. 13, which is a perspective view of an embodiment of the filter housing, the housing may be of other shapes such as generally retangular.